Predicting the Relative Impacts of Urban Development on Air Quality: A Comparative Study of the Impacts of Land Cover and Transportation

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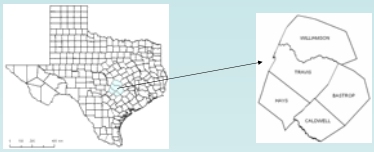
Background

Future growth due to urban development results in changes to land use and land cover and, consequently, to biogenic and anthropogenic emissions, meteorological processes, and processes such as dry deposition, which is a physical removal mechanism for air pollutants from the atmosphere. Predicting the relative impacts of development is complex; the location, pattern, and intensity of current and future human activity are highly dependent on population and policy, economic trends, and technology.

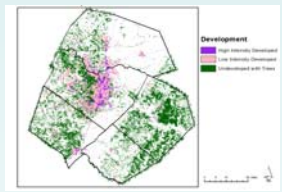
The primary objective of this on-going project is to develop and apply approaches for evaluating the air quality impacts of alternative urban growth scenarios. This study uses the Austin, Texas, metropolitan statistical area (MSA) as a case study. Austin was among the first areas to prepare an Early Action Compact (EAC) under the 8-hour NAAQS for ozone and is typical of many urban areas that are or could be facing designation as non-attainment. The initial results presented here specifically focus on the relative impacts of urbanization on air quality due to changes in land cover and transportation systems.



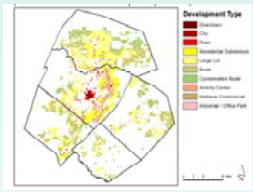
Case Study Area: Austin, Texas

Envision Central Texas

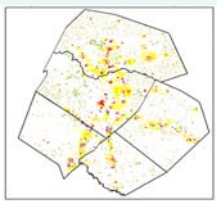
Envision Central Texas (ECT) is a community-driven regional "visioning" initiative that began in 2001. Through a public input process, ECT developed four growth scenarios (Scenarios A-D) for Austin based on an assumed doubling of population within 20-40 years. The figures for ECT Scenarios A-D below show where *changes* in development are expected to occur relative to 2001 land use patterns.



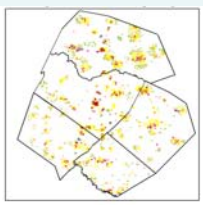
Interpretation of 2001 Landsat imagery



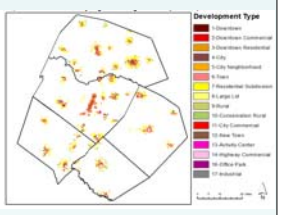
ECT A: Changes if current development trends continue



ECT B: Changes due to growth along major transportation corridors

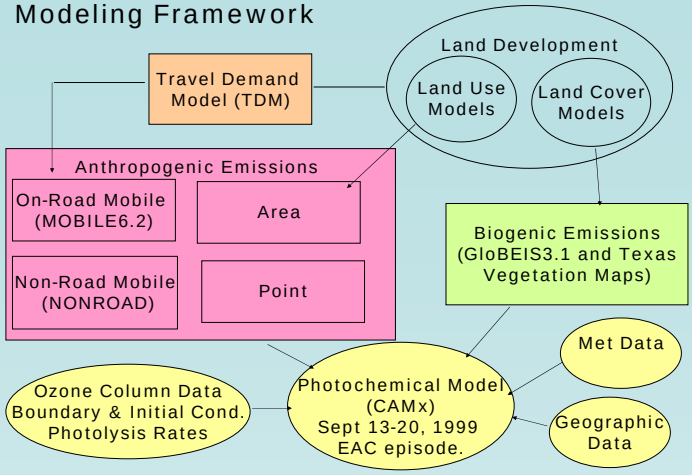


ECT C: Changes due to clustered growth in new and existing communities



ECT D: Changes due to growth in existing communities via infill and redevelopment

Modeling Framework



Impacts on Emissions and Air Quality

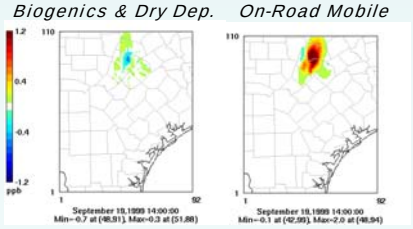
1. Although VMT is predicted to continue increasing, emissions of NOx and VOCs are predicted to decrease through approximately 2025 due to the phase-in of new emission standards.

Scenario (Weekday)	Daily VMT	NOx (tpd)	VOC (tpd)	CO (tpd)
2007	44,507,511	62.1	33.7	458.3
ECTA	82,357,589	18.4	22.0	478.3
ECTB	72,220,724	15.9	19.2	413.7
ECTC	69,503,000	15.6	18.8	403.4
ECTD	65,661,206	14.4	17.0	372.9

2. With other factors remaining unchanged, future changes in biogenic emissions and dry deposition due to a doubling of population (ECT A) resulted in impacts of -1.1 ppb to +0.5 ppb on ozone concentrations relative to 2007 levels and were comparable in magnitude to some commonly employed air pollution control measures. Similarly, impacts from on-road mobile sources were -9.2 ppb to 1.6 ppb.

3. Differences in ozone concentrations between urban development scenarios were -1.0 ppb to 0.4 ppb for changes due to biogenic emissions and dry deposition and -0.3 ppb to 2.2 ppb from changes associated with on-road mobile sources.

Biogenics & Dry Dep. *On-Road Mobile*



Examples of relative differences in 1-hr ozone concentrations between ECT A and ECT D [$O_{3(ECT\ A)} - O_{3(ECT\ D)}$] at 1400 on 9/19 due to changes in land cover and transportation, respectively

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